Development of a New *in vitro* System for Cystic Fibrosis Research

Barbara M. Coffey[1], Gregory G. Anderson[1]
[1]Department of Biology, Indiana University Purdue University Indianapolis

Individuals with cystic fibrosis (CF) have a life expectancy of 40 years and require daily treatments to mitigate the effects of the disease. CF impacts organs throughout the body, especially the lungs, where thick mucus builds up, impairs breathing, and provides an environment for bacterial growth. Chronic lung infection is the leading cause of mortality in CF. The majority of CF lung infections are caused by *Pseudomonas aeruginosa*, a common bacterium which typically does not cause disease in healthy individuals. In the CF lung, however, *P. aeruginosa* burrows into the thick mucus layer, evades the immune system, and resists antibiotic therapy by encasing itself in a protective matrix called a biofilm. Laboratory methods for studying biofilm are not true replicas of the CF lung environment, leaving a knowledge gap between how bacteria grow in a test tube (*in vitro*) and how they grow in the lungs of a person with CF. The focus of this work is to develop an improved laboratory model which combines artificial sputum (as a surrogate for mucus in the CF lung) and cultured CF airway epithelial cells. To assess the potential of this model, we have performed experiments to compare *P. aeruginosa* in artificial sputum versus standard laboratory media. Results demonstrate that *P. aeruginosa* in artificial sputum exhibits differences in growth, biofilm formation, toxin production, cytotoxicity, and protein expression, compared to results in standard media. These data suggest that our model system can contribute new information to the understanding of CF airway infection. The aim of future studies is to use this system to identify sputum components and bacterial proteins which have not been recognized previously by standard methods. It is our ultimate goal to contribute knowledge leading to improved longevity and quality of life for people with CF.

Advisor: Gregory G. Anderson, Department of Biology, Indiana University Purdue University Indianapolis